Research Note

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SEEDING GRASS BY AIRPLANE ON WESTERN MONTANA'S BURNED-OVER TIMBERLANDS

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The picture of economic devastation left by a forest fire can frequently be brightened by broadcasting grass seed over the burn from an airplane. The soil protecting cover obtained may not look as good to a lumberjack as a thrifty stand of ponderosa pine, but it is much better than only barren, eroding soil beneath the blackened snags. Airplane seeding to grass has also proved to be a practical means of providing abundant forage on burned-over lands during the period that the forest cover is re-establishing itself.

An example of worthwhile results.

Results obtained on the 1944 Henry Creek burn on the Cabinet National Forest a few miles east of Plains, Montana prove that successful seeding can be done at very low cost. The Cabinet National Forest and the Northern Rocky Mountain Forest and Range Experiment Station together seeded a selected area of about 225 acres of the Henry Creek burn on November 3, 1944. The total cost for seed and airplane hire amounted to a little under $1.50 per acre. In July 1946, the second growing season for the grass, it was estimated (on the basis of sample plots clipped to 1 inch above ground level) that there was an average of 2620 pounds of green forage per acre on the 225-acre seeded area. This included some 20 acres of open ridges where seeding was unsuccessful because the openings were occupied by native plants not killed by the fire, and some 30 acres of dry, rocky ridges where production was low. On the moderately favorable sites which totaled about 170 acres or 75 percent of the seeded area, the yield was estimated at a little over 3000 pounds of green forage per acre. This yield represents a grazing capacity of approximately 3/4 of a cow month per acre, assuming conservative use (50 percent of the available forage). A similar unseeded area nearby produced about 1400 pounds of weeds, mainly China lettuce, knotweed, and mustard, in contrast to the 3000 pounds of timothy, orchard-grass, Kentucky blue, and bulbous bluegrass on the seeded portion of the burn.

Conditions must be right for success.
Success similar to that at Henry Creek cannot be obtained on every area that happens to be swept by a forest fire. The area seeded there was selected from the 3895-acre burn as one of the portions offering the best chance for success. It is a north-facing slope about 80 percent of which was covered by a dense stand of pole-size ponderosa pine and Douglas-fir that was all killed by the fire. The soil in general is moderately good, but there are some rocky areas with very little soil. Elevation is estimated to be about 3500 feet. Precipitation is probably somewhat better than the 14.08-inch annual average recorded for Plains, which is roughly 800 to 1000 feet lower than the seeded area. The winter of 1944-45 was rather dry but spring moisture was about normal.

Conditions were less favorable on the portion of the O'Keefe Creek burn on the Lolo National Forest a few miles northwest of Missoula, which was seeded by airplane in October 1945. Here the slopes are mainly south-facing, and only about 20 to 25 percent of the seeded area was covered with trees. The rest of the area supported grass and brush, which was damaged but not all killed by the fire. The soil is less favorable than at Henry Creek, especially on the exposed slopes and ridges where vegetative cover was thin. The seeded area lies mainly above 4000 feet elevation and average annual precipitation is estimated to be about the same or possibly a little less than at Henry Creek.

Establishment of the seeded grasses at O'Keefe Creek was doubtless retarded by the extremely dry weather in the spring following seeding. At the Missoula airport only 0.69 inch instead of the normal 2.65 inches of rain fell during April and May. In spite of this dry weather, seeding was successful on the more heavily timbered portions, but very little grass has become established on the rest of the area.

Results at Henry Creek and O'Keefe Creek have been studied to determine why seeding was successful in some places and failed in other places at both areas. The following conclusions are well supported by evidence on the ground.

1. Chances for successful seeding are very good under dense stands of fire-killed timber. There seem to be several logical reasons for this:

   (a) Not many grasses or shrubs ordinarily grow under dense timber. When the trees are killed by fire there is little vegetation left to compete with the seeded grasses.

   (b) Dense timber frequently produces such a hot fire that it not only kills the trees but also most of whatever scattered undergrowth is present.

   (c) Dense timber is often an indication of fair or better soil and moisture conditions.

   (d) Burning of the soil litter, small twigs, and leaves results in a considerable layer of loose ashes that provides both cover for the seed and extra nutrients for the seedlings.

Figure 1. (above) Portion of Henry Creek burn in October 1944, three months after fire. Note thick timber stand, complete kill, bare soil--conditions favorable for seeding.

Figure 2 (below) Same general location on Henry Creek burn as shown in Figure 1. Picture taken in August 1946, second growing season after seeding by airplane. This represents about $1\frac{1}{2}$ tons of green forage per acre, mainly timothy, orchardgrass, Kentucky blue, and bulbous bluegrass. Erosion is controlled.

Figure 3. (above) Growing conditions similar to those in Figures 1 and 2 on nearby unseeded portion of Henry Creek burn, August 1946. Compare forage production and soil protection shown here with that in Figure 2.

Figure 4. (below) Opening in timber stand, August 1946, on seeded part of Henry Creek burn. Seed was wasted here because native plants not killed by fire came back promptly and kept seedlings from getting started. Such small areas cannot be missed when seeding by air, but this demonstrates a condition which, if widespread, prevents successful airplane seeding.

Thus a hot fire in dense timber provides the type of seedbed required for successful broadcast seeding; fair to good soil and moisture conditions, a clean, competition-free seedbed, a loose enough surface to provide covering of seed, and abundant nutrients for good seedling growth.

2. Seeding is less likely to be worthwhile on burns in open or widely scattered timber because:

   (a) Pinegrass and several other native grasses and shrubs which are not readily killed by fire usually grow under open stands of timber.

   (b) Where the fire must be carried from tree to tree by ground cover, it frequently does not get hot enough to kill or seriously damage the grasses and shrubs which are thus able to come back promptly and compete with the seeded grasses.

   (c) Frequently timber stands are open because the soil is too rocky and thin or the site too dry to support dense stands. These conditions are unfavorable both for establishment of grass seedlings and for high forage production.

   (d) The soil under open stands is frequently so firm or crusted with moss that broadcast seed is not likely to be covered by natural means. The ashes resulting from burning of the light soil litter are not enough to cover the seed or enrich the soil appreciably.

3. For best success seeding must be done during the first fall following the fire, before the soil becomes crusted, before the ashes are washed away, and before other plants can get a head start on the seeded grasses. This does not mean that worthwhile results cannot be obtained by seeding at a later date, but that seedbed conditions ordinarily become less favorable with each passing month.

How it was done at Henry and O'Keefe Creeks.

The plane used for seeding the two areas mentioned was a 6-place Travelair often used for dropping smoke jumpers and supplies on forest fires. The seed was broadcast from a crude hopper, home-made from a wooden packing box and a 2-foot length of 6-inch galvanized stove pipe. The box was placed in the doorway of the plane with the stove pipe sticking out at an angle, down and back. No special force-feed or spreader was used. The suction of the slip stream was strong enough to draw the last handful of seed from the hopper. Rate of seeding was regulated with a sliding paddle over the hole in the box. This seeding arrangement is not recommended because it blocks the doorway for emergency use, but it did a very satisfactory job and demonstrates that only a simple seeding hopper is needed. The plane carried 3 men and 500-600 pounds of seed, which was loaded at the Plains landing field about 7 miles from the seeded area. Cost of distributing the seed from there was a little less than 25 cents per acre. Flying time from

Missoula to Plains and back added a little over 25 cents per acre to the cost. All flying time and seed is included in the $1.50-per-acre cost figure.

Flying speed was 90 miles per hour at an average height of about 500 feet above the ground. The pilot tried to fly in 2-chain strips and at that rate covered 24 acres per minute. No ground control was used to guide the pilot, but since no missed strips have been found and the seed came out about right with the calculated 5 pounds per acre, it seems that the spacing must have been satisfactory. The use of flagmen or some other form of ground control to guide the pilot is recommended for larger seeding jobs.

Some things to consider in deciding whether or not to seed.
The role that airplane seeding of burned-over timberland to grass should play in a progressive land use program for western Montana is not yet entirely clear. That seeding can be done successfully and economically under certain conditions has been shown, and the principal site factors influencing success have been determined. Some of the other factors affecting desirability of seeding have not been defined except in a general way.

Several questions deserve careful thought in connection with each burn that occurs on an area that is adapted to successful seeding:

1. How great is the danger of erosion if the area is left unseeded? Will the area itself suffer serious loss of soil and will downstream values be endangered while natural revegetation is taking place?

2. Is the land of more value to the community (or to the individual if privately-owned) as timberland or as grassland? Since timber is a long-term crop it is necessary to consider long-term values.

3. If more valuable as timberland:

   (a) What are the prospects for suitable natural reproduction? If poor, is replanting to trees possible or feasible?

   (b) To what extent would seeding to grass and subsequent grazing retard timber reproduction?

   (c) Will erosion control and forage production justify seeding even though reproduction may be retarded somewhat?

4. If timber reproduction is not especially desirable:

   (a) How long will it be until the grass is crowded or shaded out by brush or trees?

(b) How long will it be until fallen trees and snags will seriously interfere with grazing of domestic stock?

These questions cannot be answered definitely at this time nor can formulas be given for finding the answers under specific circumstances. However, experience has yielded some general information that should be helpful.

1. Grass is very effective in preventing excessive run-off and in holding soil against erosion. Under the conditions described as favorable for airplane seeding it should begin to be effective within less than a year after seeding.

2. Although grass seeding in some cases has greatly retarded timber reproduction, it will also retard the invasion of low value weeds, grasses, and shrubs which also interfere with timber reproduction. Studies in Oregon showed that in one case seeding to grass prevented excessively thick stands of lodgepole pine by reducing establishment on the seeded area to 7 percent of the number of trees established on an adjacent unseeded area. (Pickford, G.D. & E.R. Jackman - Reseeding eastern Oregon summer ranges. Sta. Circ. #159, 1944 - Oregon State College, Corvallis, Oregon.) The effect on other tree species and under a variety of conditions has not been determined.

3. That seeding grass will not entirely prevent reproduction of ponderosa pine when pine seed is available promptly is indicated by results on the Sleeping Child area of the Bitterroot National Forest. Grass was seeded there on skid trails in the fall of 1939 and spring of 1940 on an area logged in 1939. Excellent pine reproduction occurred on some of the same spots where some of the best grass stands were obtained. In 1944 young ponderosa pine and crested wheatgrass were growing together without apparent conflict.

4. Orchardgrass, timothy, bulbous bluegrass, Kentucky bluegrass, tall oatgrass, and smooth brome are well adapted to airplane seeding on properly selected burned-over timberlands in western Montana. Crested wheatgrass has shown some promise, but has not done as well on timbered sites as the other grasses mentioned.

5. Seeding grass on suitable burned-over timberland can provide the additional good forage so badly needed in many western Montana communities. Indications are that it will be usable for several years, at least, before it is crowded out by trees or brush or made unavailable by fallen timber. Low seeding costs and high production combine to make airplane seeding pay for itself in a short time.

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